Patent Claims

1. Bending machine for the bending of rod-shaped and/or bar-shaped workpieces and especially of pipes, with a bending device (5, 105) that encompasses selectively deployable bending tools (10, 11; 110, 111) of which at least one is provided on one side and at least one on the opposite side of a tool platen (12, 112) and each of which includes at least one bending swage (13, 16; 113, 164; 116, 165) as well as at least one thrust member, which for switching between an operating and an idle position can be power-driven back and forth in the transverse direction of the workpiece, said bending swages (13, 16; 113, 164; 116, 165) being positioned along a bending axis (19, 119) that extends in the transverse direction of the workpiece, with the operating position of at least one thrust member on one side of the tool platen (12, 112) coordinated with the idle position of at least one thrust member on the other side of the tool platen (12, 112) while the workpiece on the active bending tool (10, 11; 110, 111), when effectively impacted in the transverse direction of the workpiece, can be bent around the bending swage (13, 16; 113, 164; 116, 165) by means of at least one thrust member in its operating position, characterized in that at least one thrust

member on one side and at least one thrust member on the other side of the tool platen (12, 112) are coupled and jointly driven for their movement in the transverse direction of the workpiece, and that, as the thrust member(s) on one side of the tool platen (12, 112) is/are moved in the transverse direction into its/their operating position, the associated thrust member(s) on the other side of the tool platen (12, 112) can be moved the opposite way in the transverse direction of the workpiece.

2. Bending machine as in claim 1, characterized in that, as mutually associated thrust members capable of moving in opposite ways in the transverse direction of the workpiece, clamping jaws (14, 17; 114, 166; 117, 168) are provided of which at least one is positioned on one side and at least one is positioned on the other side of the tool platen (12, 112) and which are mounted on a swivel arm (20, 120) that can be swiveled around the bending axis (19, 119), that the workpiece on the active bending tool (10, 11; 110, 111) can be clamped between the bending swage (13, 16; 113, 164; 116, 165) and at least one clamping jaw (14, 17; 114, 166; 117, 168) that is in its operating position forcing the workpiece against the bending swage (13, 16; 113, 164; 116, 165), and, so clamped, the workpiece can be bent around the bending swage (13, 16; 113, 164; 116, 165) as the swivel arm (20, 120) with the clamping jaws (14, 17; 114, 166; 117, 168) is swiveled.

3. Bending machine as in one of the preceding claims, characterized in that, as mutually associated thrust members capable of moving in opposite ways in the transverse direction of the workpiece, slide rails (15, 18; 115, 167; 118, 169) are provided of which at least one is positioned on one side and at least one is positioned on the other side of the tool platen (12, 112) and which, as viewed in the longitudinal direction of the workpiece, are situated on the far side of the bend to be produced relative to the clamping jaws (14, 17; 114, 166; 117, 168) of the respective bending tools (10, 11; 110, 111), and that, as the workpiece is bent on the active bending tool (10, 11; 110, 111) around the bending swage (13, 16; 113, 164; 116, 165), it can be buttressed in the transverse direction of the workpiece by means of at least one slide rail (15, 18; 115, 167; 118, 169) that is in its operating position in the transverse direction of the workpiece.

4. Bending machine as in one of the preceding claims, in which bending tools (10, 11; 110, 111) are provided on both sides of the tool platen (12, 112) with thrust members each in the form of at least one clamping jaw (14, 17; 114, 166; 117, 168) and at least one slide rail (15, 18; 115, 167; 118, 169), characterized in that at least one clamping jaw (14, 17; 114, 166; 117, 168) on one side and at least one clamping jaw (14, 17; 114, 166; 117, 168) on the other side of the tool platen (12, 112) are drive-coupled for their movement in the transverse direction of the workpiece and can be moved in the opposite direction, and that, as the workpiece is being bent, at least one of the slide rails (15, 18; 115, 167; 118, 169) of the active bending tool (10, 11; 110, 111), when in its operating position, can be moved in power-driven fashion in the longitudinal direction of and jointly with the workpiece.

5. Bending machine as in one of the preceding claims, characterized in that by means of at least one slide rail (15, 18; 115, 167; 118, 169) of the active bending tool (10, 11; 110, 111), when in its operating position in the transverse direction of the workpiece and movable with the workpiece in the longitudinal direction of the latter, at least one slide rail (15, 18; 115, 167; 118, 169) of a bending tool (10, 11; 110, 111) on the opposite side of the tool platen (12, 112) is coupled to be jointly driven in the longitudinal direction of the workpiece.

6. Bending machine as in one of the preceding claims, characterized in that the slide rails (15, 18; 115, 167; 118, 169), drive-coupled for joint movement in the

longitudinal direction of the workpiece, can be moved in the same longitudinal direction of the workpiece on both sides of the tool platen (12, 112)

7. Bending machine as in one of the preceding claims, characterized in that on one side of the tool platen (12, 112) at least one bending tool (10, 11; 110, 111) is provided with a bending swage (13, 16; 113, 164; 116, 165) featuring a larger bending radius than the bending swage (13, 16; 113, 164; 116, 165) of at least one bending tool (10, 11; 110, 111) on the opposite side of the tool platen (12, 112), that the respectively associated thrust members that can be moved in opposite ways in the transverse direction of the workpiece are provided in the form of opposite-sense clamping jaws (14, 17; 114, 166; 117, 168) and/or opposite-sense slide rails (15, 18; 115, 167; 118, 169), that on the active bending tool (10, 11; 110, 111) at least one slide rail (15, 18; 115, 167; 118, 169), occupying its operating position in the transverse direction of the workpiece, can be power-driven in the longitudinal direction of and together with the workpiece as the workpiece is being bent, and that this slide rail or these slide rails (15, 18; 115, 167; 118, 169) can be drive-coupled with at least one slide rail (15, 18; 115, 167; 118, 169) of a bending tool (10, 11; 110, 111) on the opposite side of the tool platen (12, 112) for travel, and permitting parallel movement, in the longitudinal direction of the workpiece.

8. Bending machine along the main concept of claim 1, with thrust members in the form of slide rails (15, 18; 115, 167; 118, 169), whereby the workpiece on the active bending tool (10, 11; 110, 111), as it is bent around the bending swage (13, 16; 113, 164; 116, 165), can be buttressed by means of at least one slide rail (15, 18; 115, 167; 118, 169) that is in its operating position in the transverse direction of the workpiece, characterized in that at least one slide rail (15, 18; 115, 167; 118, 169) of the active bending tool (10, 11; 110, 111), when in its operating position in the transverse direction of the workpiece, can be power-driven in the longitudinal direction of and jointly with the workpiece as the workpiece is being bent, and that the said slide rail or rails (15, 18; 115, 167; 118, 169) is/are drive-coupled with at least one idle slide rail (15, 18; 115, 167; 118, 169) of a bending tool (10, 11; 110, 111) on the opposite side of the tool platen (12, 112) for movement in the longitudinal direction of the workpiece.

9. Bending machine as in claim 8, characterized in that the slide rails (15, 18; 115, 167; 118, 169), drive-coupled for movement in the longitudinal direction of the workpiece, can be moved in parallel on both sides of the tool platen (12, 112) in the longitudinal direction of the workpiece.

10. Bending machine as in claim 8 or 9, characterized in that the slide rails (15, 18; 115, 167; 118, 169), drive-coupled for movement in the longitudinal direction of the workpiece on both sides of the tool platen (12, 112), are also drive-coupled for travel in the transverse direction of the workpiece.

11. Bending machine as in one of the claims 8 to 10, characterized in that the slide rails (15, 18; 115, 167; 118, 169), drive-coupled for movement in the longitudinal direction of the workpiece on both sides of the tool platen (12, 112), can be moved in an opposite sense along the transverse direction of the workpiece.

12. Bending machine as in one of the claims 8 to 11, in which bending tools (10, 11; 110, 111) on both sides of the tool platen (12, 112) each employ thrust members in the form of at least one slide rail (15, 18; 115, 167; 118, 169) and at least one clamping jaw (14, 17; 114, 166; 117, 168), characterized in that slide rails (15, 18; 115, 167; 118, 169) on both sides of the tool platen (12, 112) are drive-coupled for movement in the longitudinal direction of the workpiece and in the transverse direction of the workpiece, while clamping jaws (14, 17; 114, 166; 117, 168) on both sides of the tool platen (12, 112) are drive-coupled for movement in the transverse direction of the workpiece.

13. Bending machine as in at least one of the preceding claims, characterized in that for the drive-coupled movement of thrust members such as clamping jaws (14, 17; 114, 166; 117, 168) and/or slide rails (15, 18; 115, 167; 118, 169) on both sides of the tool platen (12, 112) in the transverse direction of the workpiece at least one common cross feed motor (26, 49) is provided.

14. Bending machine as in at least one of the preceding claims, characterized in that for the drive-coupled movement of slide rails (15, 18; 115, 167; 118, 169) on both sides of the tool platen (12, 112) in the longitudinal direction of the workpiece at least one common longitudinal drive motor (171) is provided.

15. Bending machine as in at least one of the preceding claims, characterized in that mutually associated thrust members on both sides of the tool platen (12, 112) can be moved in an opposite sense along the transverse direction of the workpiece by means of drive elements that permit opposite-sense movement in the transverse direction of the workpiece and are motionally interconnected, that for each of these drive elements end stops are provided which serve in both directions of travel and which backstop the drive elements in the event of delayed movement and especially stoppage of the associated thrust member(s) while the drive elements nevertheless continue to move, and that between each drive element and one of its end stops a damping device (41, 42; 57, 58) is provided by means of which the impact of the drive element on the end stop can be attenuated, that in the case of an identical direction of travel of the drive elements functional end stops are attenuated, that when one of the drive elements would strike an unattenuated end stop the respective other drive element moving in the opposite direction will impinge on the end stop that functions in its own direction of travel and is attenuated by means of the damping device (41, 42; 57, 58), said drive elements that move in opposite directions being connected in attenuation-transferring fashion.

16. Bending machine as in at least one of the preceding claims, characterized in that the opposite-sense drive elements are provided in the form of spindles (31, 32; 51, 54) and/or spindle nuts (33, 35; 52, 55) of spindle drives (34, 36; 50, 53) that move the thrust members in the transverse direction of the workpiece.

17. Bending machine as in at least one of the preceding claims, characterized in that a common longitudinal drive motor (171), moving the drive-coupled slide rails (15, 18; 115, 167; 118, 169) in the longitudinal direction of the workpiece, is drive-connected with the slide rails (15, 18; 115, 167; 118, 169) on both sides of the tool platen (12, 112) by way in each case of a longitudinal feedgear mechanism (178, 184) that encompasses a gear element (181, 187) movable in the transverse direction of the workpiece on the slide-rail side and, between that element and the longitudinal drive motor (171), a transmissive connection (183, 189), and that the transmissive connections (183, 189) between the longitudinal drive motor (171) and the gear elements (181, 187) on the slide-rail side on both sides of the tool platen (12, 112) are each rotatable with their drive-motor side, jointly with the longitudinal drive motor (171), around the associated gear element (181, 187) on the slide-rail side while being mutually connected in articulated fashion on their respective drive-motor side, with the common linkage axle (177) of the transmissive connections (183, 189) on the drive-motor side and the swivel pins (175, 176) of the transmissive connections (183, 189) on the gear elements (181, 187) on the slide-rail side extending parallel to each other in the longitudinal direction of the workpiece.

18. Bending machine as in at least one of the preceding claims, characterized in that the common linkage axle (177) of the transmissive connections (183, 189) on the drive-motor side is constituted of the motor shaft of the longitudinal drive motor (171).

19. Bending machine as in at least one of the preceding claims, characterized in that at least one longitudinal feedgear mechanism (178, 184) between the common longitudinal drive motor (171) and the slide rails (15, 18; 115, 167; 118, 169) encompasses a spindle drive (179, 185) with spindle drive elements in the form of a gear spindle (182, 188) that extends in the longitudinal direction of the workpiece and, mounted on it, a spindle nut (181, 187), that at least one slide rail (15, 18; 115, 167; 118, 169) is coupled with one of the spindle drive elements so as to permit movement in the longitudinal direction of the workpiece while the other spindle drive element constitutes a gear element on the slide-rail side, that the transmissive connection between the common longitudinal drive motor (171) and the spindle drive element in the form of the gear element on the slide-rail side is a continuous revolving drive element, capable of being powered by the common longitudinal drive motor (171), and in particular a drive belt (183, 189), by means of which the spindle drive element constituting the gear element on the slide-rail side can be moved around the axis of the gear spindle (182, 188).

20. Bending machine as in at least one of the preceding claims, characterized in that the gear elements on the slide-rail side on both sides of the tool platen (12, 112) are each positioned on a support that can be moved on the tool platen (12, 112) in the transverse direction of the workpiece, that on each support a rocker (173, 174) is mounted in a manner as to permit rotation around the swivel pin (175, 176) of the respective transmissive connection (183, 189), and that the rockers (173, 174) are linked together at a distance from their mounts on the supports with the common longitudinal drive motor (171) mounted on them, and that the common linkage axle (177) of the rockers (173, 174) and their swivel pins (175, 176) extend on the supports parallel to one another in the longitudinal direction of the workpiece.